CLAIMS

We claim:

1. A method of controlling birefringence in an arrayed waveguide grating comprising:

determining a stress distribution in a top cladding layer and in at least one waveguide in the arrayed waveguide grating over a change in manufacturing temperature;

determining a relationship between polarization dependent wavelength and a width of the waveguide from the stress distribution; and

selecting the width of the waveguide such that the polarization dependent wavelength is a predetermined value.

2. The method of claim 1 wherein the predetermined value is a minimized polarization dependent wavelength.

3. The method of claim 1 further comprising determining an elastic modulus of each of the top cladding layer and the waveguide prior to determining the stress distribution.

4. The method of claim 3 further comprising determining a coefficient of thermal expansion in each of the top cladding layer and the waveguide.

5. The method of claim 1 wherein determining the relationship between polarization dependent wavelength and the waveguide width from the stress distribution further comprises mapping the stress distribution into an index distribution.

6. The method of claim 5 further comprising determining an effective index of each of the waveguide and the top cladding.

7. The method of claim 1 wherein determining the relationship between polarization dependent wavelength and the waveguide from the stress distribution further comprises determining a distribution of refractive index in the top cladding from the stress distribution.

8. The method of claim 2 wherein the minimized polarization dependent wavelength is zero.

9. The method of claim 1 wherein the top cladding layer is disposed over the waveguide.

10. The method of claim 9 wherein the top cladding layer is disposed over a substrate.

11. The method of claim 10 wherein the substrate comprises silicon.

12. The method of claim 10 wherein the substrate has a thickness of about 625 μm.

13. The method of claim 10 wherein the substrate is disposed over a first layer of SiO_2.

14. The method of claim 13 wherein a second layer of SiO_2 is disposed over the substrate.

15. The method of claim 13 or 14 wherein the SiO_2 has a thickness between about 15-30 μm.

16. The method of claim 15 wherein the SiO_2 has a thickness of about 15 μm.

17. The method of claim 1 wherein the waveguide further comprises at least one dopant.

18. The method of claim 17 wherein the at least one dopant is selected from the group consisting of Germanium and Phosphorus.

19. The method of claim 1 wherein the waveguide comprises at least one material selected from the group consisting of polyacrylates, polymethacrylates, polysilicone, polyimide, epoxy, polyurethane, polyolefin, polycarbonate, polyamides, polyesters, acrylate-methacrylate copolymers, acrylic-silicone copolymers, epoxy-urethane copolymers, and amide-imide copolymers.

20. The method of claim 1 wherein the waveguide has a height between about 5-8 μm.

21. The method of claim 20 wherein the waveguide has a height of about 6 μm.

22. The method of claim 1 wherein the top cladding layer further comprises a dopant.

23. The method of claim 22 wherein the dopant comprises Boron.

24. The method of claim 23 wherein the Boron ranges between about 6-9% by weight.

25. The method of claim 1 wherein the change in manufacturing temperature is about 900° C.

26. An arrayed waveguide grating which controls birefringence comprising:

a substrate;

a top cladding layer disposed upon the substrate; and

at least one waveguide having a width and a height disposed between the substrate and the top cladding layer,

the width of the waveguide being selected such that a polarization dependent wavelength is a predetermined value.

27. The arrayed waveguide grating of claim 26 wherein the predetermined value is a minimized polarization dependent wavelength.

28. The arrayed waveguide grating of claim 26 wherein the polarization dependent wavelength is determined from a stress distribution in the top cladding layer and in the waveguide over a change in manufacturing temperature.

29. The arrayed waveguide grating of claim 26 wherein the top cladding layer comprises a predetermined composition.

30. The arrayed waveguide grating of claim 28 wherein the polarization dependent wavelength is further determined from an elastic modulus of each of the top cladding layer and the waveguide.

31. The arrayed waveguide grating of claim 30 wherein the polarization dependent wavelength is further determined from a coefficient of thermal expansion in each of the top cladding layer and the waveguide.

32. The arrayed waveguide grating of claim 27 wherein the minimized polarization dependent wavelength is zero.

33. The arrayed waveguide grating of claim 26 wherein the substrate comprises silicon.

34. The arrayed waveguide grating of claim 26 wherein the substrate has a thickness of about 625 μm.

35. The arrayed waveguide grating of claim 26 wherein the substrate is disposed over a first layer of SiO_2.

36. The arrayed waveguide grating of claim 35 wherein a second layer of SiO_2 is disposed over the substrate.

37. The arrayed waveguide grating of claim 35 or 36 wherein the SiO_2 has a thickness between about 15-30 μm.

38. The arrayed waveguide grating of claim 37 wherein the SiO_2 has a thickness of about 15 μm.

39. The arrayed waveguide grating of claim 26 wherein the waveguide further comprises at least one dopant.

40. The arrayed waveguide grating of claim 39 wherein the at least one dopant is selected from the group consisting of Germanium and Phosphorus.

41. The arrayed waveguide grating of claim 26 wherein the waveguide comprises at least one material selected from the group consisting of polyacrylates, polymethacrylates, polysilicone, polyimide, epoxy, polyurethane, polyolefin, polycarbonate, polyamides, polyesters, acrylate-methacrylate copolymers, acrylic-silicone copolymers, epoxy-urethane copolymers, and amide-imide copolymers.

42. The arrayed waveguide grating of claim 26 wherein the waveguide height is between about 5-8 μm.

43. The arrayed waveguide grating of claim 42 wherein the waveguide height is about 6 μm.

44. The arrayed waveguide grating of claim 26 wherein the top cladding layer further comprises a dopant.

45. The arrayed waveguide grating of claim 44 wherein the dopant comprises Boron.

46. The arrayed waveguide grating of claim 45 wherein the Boron ranges between about 6-9% by weight.

47. The arrayed waveguide grating of claim 28 wherein the change in manufacturing temperature is about 900° C.